



Update of Area-Wide Need-Based Planning Model for Oral Health Services

Missouri Department of Health and
Senior Services





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In 2005, through a contract between the Missouri Department of Health and Senior Services and the University of Missouri-Kansas City School of Dentistry, a methodology to estimate the demand-based dental needs of the population in a defined area was developed. The model that was developed was designed to project both the need for oral health services within a defined region and the oral health work force needed to assure access and quality care. The methodology was based on population characteristics (within a geographic area), disease prevalence, water fluoridation, pregnancy, poverty and estimates of dental disease and morbidity as determined from a standard national database, the National Health and Nutrition Examination Survey (NHANES) III.

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Missouri Department of Health and Senior Services
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Data Methodology

Data from NHANES 1999-2002 were used for updating the need-based workforce model for oral health care in the State of Missouri. The survey examined a nationally representative sample of about 5,000 persons each year from 1999 to 2002. There were 21,004 persons selected and interviewed over four years. Demographic variables included gender, ethnicity, age at examination, and the poverty index (PI). Medical history was obtained in the interview, including information on asthma, arthritis, cancer or malignancy, chronic bronchitis, coronary heart diseases, ear infections, diabetes, hay fever, and stroke. Oral health examinations were conducted in the Mobile Examination Centers and included dentition assessments and periodontal assessments. Caries and periodontal data were combined into one database. Participants with a percent of any caries experience, untreated coronal caries, untreated root caries, loss of attachment (LOA) ≥ 3 mm, and LOA ≥ 5 mm were calculated for age and gender-specific groups. Mean number of untreated coronal caries, untreated root caries, and mean number of teeth with LOA ≥ 5 mm were also calculated for age and gender-specific groups. But only a percent of untreated coronal caries, a percent of untreated root caries, and a percent of teeth with ≥ 5 mm were used for updating the current workforce model for oral health care. The other important information can be utilized if more in depth updates are required. According to the NHANES Analytic and Reporting Guidelines, appropriate weighting methodology is used for adjustment for the complex sample design provided by the NHANES data 1999-2002.

Projecting Oral Health Needs

The updated model utilized age and gender specific dental morbidity data accessed from the NHANES (1999-2002). Data were assembled for 19 age-gender cohorts and three oral health status indicators (see Appendix 1).

- LOA > 5mm – This is an indicator of severe periodontal disease, it means there is a loss of LOA of teeth to gums that exceeds five millimeters
- Coronal caries – decay in the crown of the tooth
- Root caries – decay in an exposed root

Each condition requires dental attention.

The updated model makes the following assumptions:

- Every person requires two preventive/health maintenance dental visits per year, regardless of their oral health status.
- Persons with LOA > 5 mm require two additional visits per year to manage this condition
- Persons with coronal caries requires one additional visit
- Persons with root caries require one additional visit per year
- Conditions are additive; persons with LOA > 5mm may also have dental caries and require dental visits for each condition
- Environmental and sociological factors also play a role.
 - Where counties lack water fluoridation, 30 percent to the presumed caries rate was added for each age cohort

- Pregnancy – one additional visit for each pregnancy
- Diabetes – two additional visits case of diabetes (computed by multiplying the diabetes prevalence rate by population in the county)

Division of Labor among General Dentists and Specialists

The need-based component of the model enables us to predict the number of dental office visits necessary to treat a geographically-defined population

Need should not be confused with demand. Need relates to the clinical requirements and conditions necessitating dental care for a defined population. Demand is a market-based concept dealing with the actual behavior of individuals who have needs seeking care. Because of information deficiencies, financial constraints, transportation problems and scheduling conflicts, the actual number of visits demanded by a defined population will generally be less than what is needed. Among low-income individuals, the differences may be quite dramatic. The workforce model, assumptions and discussions would need to consider this fact. This workforce model projects the number of dental professionals that would be needed if there were no barriers (information, finances, transportation, etc.) to accessing clinically-appropriate care.

To derive the need for general dentists, dental specialists, dental hygienists and dental assistants, two other determinations were needed:

- how general dentists and specialists divide the dental workload
- the productivity of the oral health teams led by these generalists and specialists

The Division of Labors determinations of generalists and specialists utilizing CDT-2 data were taken from the ADA's 2005-2006 *Survey of Dental Services Rendered*. The data examined the division of dental procedures among general practitioners, endodontists, oral surgeons, orthodontists, pediatric dentists, periodontists and prosthodontists.

The development of the workforce model proceeded with a two-stage modeling process. First, dental procedures performed by orthodontists were subtracted out as they do not relate to the dental morbidity addressed in our needs-based model. Orthodontists, for the most part, do not provide services that substitute for those of general dentists or other dental specialties, and vice versa. While some general dentists do provide limited orthodontic treatment, it represents a tiny percentage of what they do, and what orthodontists do, so it was left out of the preliminary calculations.

The distribution of work among general dentists and non-orthodontic specialists is shown in Table 1 below.

Table 1: Rates of Dental Visits Distributed by Dental Specialty

GPs	Endo	OMX	Peds	Perio	Prosths
88.07%	1.25%	2.62%	4.78%	1.82%	1.00%

Utilizing the Jackson County example, our needs-based model projected the need for 2,003,727 dental visits annually (see Appendix 1). Dividing the labor according to the above percentages yields the following projected visit needs by specialty (see Table 2).

Table 2: Number of Dental Visits Using the Jackson County Example by Dental Specialty

GPs	Endo	OMX	Peds	Perio	Prosths
1,764,682	25,047	52,498	104,995	36,468	20,037

The second stage of the modeling process required the addition of orthodontic procedures (so that projections for the need for orthodontists could be made). The American Dental Association (ADA) procedure data suggested that orthodontists produce 4.92 percent of all dental procedures (and by extrapolation, office visits). This suggests that the total number of office visits annually for Jackson County residents, orthodontics included, would be 2,102,988. Orthodontists, at 4.78 percent, consequently, would produce 99,261 visits annually.

Dental Team Productivity

The next step, as suggested above, was to determine the productivity, measured in office visits, of the different oral health teams.

This had two components: 1) determining the appropriate composition of the teams and then, 2) determining the projected number of office visits each team would be expected to produce in the course of a year.

To develop these productivity assumptions, data from the ADA's Survey of Dental Practice and the Missouri Dental Board's 2008-2009 re-licensure surveys were utilized.

The results are shown in Table 3. Each team consists of a solo dentist, one or more dental assistants and, depending on the type of practitioner, zero to two dental hygienists.

Table 3: Annual Number of Dental Visits by Dental Specialty Clinic Team

	GPs	Endo	OMX	Ortho	Peds	Perio	Prosths
Dental Hygienists	1.4	0	0	0	.5	2	1
Dental Assistants	2	3	4	4	3	1.5	1
Annual Visits	3,877	1,839	2,906	7,712	6,418	3,437	2,551

Projecting Work Force Needs in Jackson County

Finally, by dividing the projected numbers of visits needed by the projected productivity of the different teams, projections were obtained. The needs for the respective team members are shown in Table 4 using Jackson County as an example.

Table 4: Annual Number of Dental Visits Using the Jackson County Example by Dental Specialty

	GPs	Endo	OMX	Ortho	Peds	Perio	Prosths	Total
Visits	1,764,682	25,047	52,498	99,261	104,995	36,468	20,037	2,102,988
Per team	3,877	1,839	2,906	7,712	6,418	3,437	2,551	--
Dentists	455	13.6	18.1	12.9	16.4	10.6	7.9	534.5
Dental Hygienists	637	0	0	0	8.2	21.2	7.9	674.3
Dental Assistants	910	40.9	72.3	51.5	49.1	15.9	7.9	1,147.6

Given the interest in expanding dental productivity through the use of Expanded Functions Dental Assistants (EFDA), computations of the work force needs for General Practice (GP) using the assumption that two EFDAs add 15 percent to the productivity of a dental office were obtained. If two EFDAs were substituted for the two DAs in the calculations above, the results are quite significant: 68 fewer dentists might be needed in Jackson County (see Table 5).

Table 5: Annual Number of Dental Visits Using the Jackson County Example by Dental Specialty Teams with Dental Assistants Trained as Expanded Functions Dental Assistants (EFDA)

	GPs	Endo	OMX	Ortho	Peds	Perio	Prosths	Total
Visits	1,764,682	25,047	52,498	99,261	104,995	36,468	20,037	2,102,988
Per Team	4,459	1,839	2,906	7,712	6,418	3,437	2,551	--
Dentists	387	13.6	18.1	12.9	16.4	10.6	7.9	466.5
DHYs	541	0.0	0.0	0.0	8.2	21.2	7.9	578.3
EFDAs	774	40.9	72.3	51.5	49.1	15.9	7.9	1,011.6

Increasing the number of dental hygienists in a general practice would also have a dramatic impact on the projected need for dentists. If there were 2.4 hygienists per GP, rather than 1.4, the number of dentists needed could also further decrease by about 10 percent or 39 FTE dentists (see Table 6).

Table 6: Annual Number of Dental Visits Using the Jackson County Example by Dental Specialty Teams with EFDAs and Increasing the Number of Dental Hygienists in the Team

	GPs	Endo	OMX	Ortho	Peds	Perio	Prosths	Total
Visits	1,764,682	25,047	52,498	99,261	104,995	36,468	20,037	2,102,988
Per Team	4,905	1,839	2,906	7,712	6,418	3,437	2,551	--
Dentists	348	13.6	18.1	12.9	16.4	10.6	7.9	427.5
DHYs	835	0.0	0.0	0.0	8.2	21.2	7.9	872.3
EFDAs	696	40.9	72.3	51.5	49.1	15.9	7.9	933.6

The point of these calculations is to demonstrate that dental productivity (and access) could be dramatically improved by increasing the number of dental hygienists and assistants in general practice.

Summary and Conclusion

This report presents an update to our earlier area-wide oral health planning model. It is a population-based model that projects the need for dental visits based on dental morbidity.

The model and the Division of Labor projects the need for oral health professionals based on dental office productivity.

Gap Analysis by County*

Introduction

Disparities in oral health have been demonstrated across rural – urban areas, socio-economic status and also based on dental insurance status. While most counties in Missouri experience varying access to oral health care, lack of data has made baseline data collection difficult. Dental need-based assessments at the county level are required to assess current status of available dental services and to identify areas of high need.

Methods

The data for the gap analysis were obtained from the Missouri Dental Board re-licensure surveys, Medicaid reports and U.S. Census data. The analyses used in these reports were limited to those respondents indicating practice in Missouri.

Dentist to Population Ratio

County level population data were obtained from the U.S. Census information available on their Web site and compared with the total number of dentists (general practitioners and specialists) indicating clinical practice in Missouri. The population per dentist was calculated to assess the geographic availability of dental care.

The dentist to population ratio was grouped to assess the counties with shortages of dentist workforce. There were five groups created based on the total dentist to population ratio: Group I were counties without a dentist; Group II were counties with the dentist to population ratio less than 5,000; Group III were counties with the dentist to population ratio between 5,001 to 7,500; Group IV were counties with the dentist to population ratio between 7,501 to 10,000; and Group V were counties with the dentist to population ratio greater than 10,000.

Dentist to Early Periodic Screening, Diagnosis and Treatment (EPSDT) Population Ratio

EPSDT (children less than 21 years of age) enrollment data by county were obtained from the 2008 Medicaid report. The county enrollment for EPSDT was examined by the total number of dentists (general practitioners and specialists) indicating clinical practice in Missouri. The EPSDT population per dentist was calculated to assess the geographic availability of dental care in Missouri counties.

The dentist to EPSDT population ratio was grouped to assess the availability of dental care by county. There were five groups created based on the total dentist to EPSDT population ratio: Group I were counties without a dentist; Group II were counties with the dentist to population ratio less 1,000; Group III were counties with the dentist to population ratio between 1,001 to 2,000; Group IV were counties with the dentist to population ratio between 2,001 to 5,000; and Group V were counties with the dentist to population ratio between 5,001 to 8,000.

Dentists by Missouri Counties

The total number of dentists was calculated for each county to include general practitioners and specialists. The number of dentists per county was grouped to assess their geographic distribution at the county level.

The groups were created as follows: Group I were counties without any practicing dentists; Group II were counties with 1 to 5 dentists; Group III were counties with 6 to 10 dentists; Group IV were counties with 11 to 20 dentists; Group V were counties with 21 to 99 dentists; Group VI were counties with 100 to 500 dentists.

Dental Hygienists by Missouri Counties

The total number of hygienists was calculated for each county for dentists indicating a clinical practice in Missouri. The number of hygienists per county was grouped to assess their geographic distribution at the county level.

The groups were created as follows: Group I were counties without any hygienists; Group II were counties with 1 to 5 hygienists; Group III were counties with 6 to 26 hygienists; Group IV were counties with 27 to 99 hygienists; Group V were counties with 100 to 196 hygienists.

Dentists Retiring Within Five years

Data from the relicensure survey was used to combine information about the retirement intention of dentists. The dentists indicating an intention to retire within the next five years was calculated for each county. This number was examined as a percentage of total dentists (general practitioners and specialists) indicating clinical practice by county. The counties were then grouped according to the percentage of dentists intending to retire within five years.

The counties were grouped as follows: Group I had zero percent of dentists retiring; Group II had 1 percent to 25 percent of dentists retiring; Group III had 26 percent to 50 percent of dentists retiring; Group IV had 51 percent to 75 percent of dentists retiring; Group V had 76 percent to 100 percent retiring.

Dentists Retiring Within 10 years

Data from the relicensure survey was used to combine information about the retirement intention of dentists. The dentists indicating an intention to retire within the next 10 years was calculated for each county. This number was examined as a percentage of total dentists (general practitioners and specialists) indicating clinical practice by county. The counties were then grouped according to the percentage of dentists intending to retire within 10 years.

The counties were grouped as follows: Group I had zero percent of dentists retiring; Group II had 1 percent to 25 percent of dentists retiring; Group III had 26 percent to 50 percent of dentists retiring; Group IV had 51 percent to 75 percent of dentists retiring; Group V had 76 percent to 100 percent retiring.

Results

There were a total of 1,808 dentists that responded to the survey and indicated they practiced in Missouri. Of these responses, 84 percent were male and 82 percent indicated they were General Practitioners and 91 percent indicated their race as Caucasian.

Dentist to Population Ratio

There were 13 counties without a practicing dentist according to the survey. There were 12 counties with more than 10,000 people per dentist; eight counties with 7,501 to 10,000 people per dentist; and 24 counties with 5,001 to 7,500 people per dentist.

Dentist to EPSDT Population Ratio

There were 13 counties without a dentist; three counties with 5,001 to 8,000 Medicaid children per dentist; 16 counties with 2,001 to 5,000 Medicaid children per dentist; 30 counties with 1,001 to 2,000 Medicaid children per dentist; and 53 counties with less than 1,000 Medicaid children per dentist.

Dentists by Missouri Counties

There were 13 counties without a dentist; 59 counties with 1 to 5 dentists; 21 counties with 6 to 10 dentists; nine counties with 11 to 20 dentists; 10 counties with 21 to 99 dentists; and three counties with 100 to 500 dentists.

Dental Hygienists by Missouri Counties

There were 57 counties where the dentist indicated there was no dental hygienist being employed; 47 counties with 1 to 5 dental hygienists; seven counties with 6 to 26 dental hygienists; three counties with 27 to 99 dental hygienists; and one county with 196 dental hygienists.

Dentists Retiring Within Five years

There were 50 counties with no dentists indicating intention to retire within five years; 40 counties with 1 percent to 25 percent of dentists indicating intention to retire within five years; 19 counties with 26 percent to 50 percent of dentists indicating intention to retire within five years; one county with 51 percent to 75 percent of dentists indicating intention to retire within five years; and five counties with 76 percent to 100 percent of dentists indicating intention to retire within five years.

Dentists Retiring within 10 years

There were 30 counties with no dentists indicating intention to retire within 10 years; 10 counties with 1 percent to 25 percent of dentists indicating intention to retire within five years; 47 counties with 26 percent to 50 percent of dentists indicating intention to retire within 10 years; 10 counties with 51 percent to 75 percent of dentists indicating intention to retire within 10 years; and 18 counties with 76 percent to 100 percent of dentists indicating intention to retire within 10 years.

Discussion

Access to care varies significantly across Missouri, especially for those on Medicaid. There were at least 19 counties with extremely limited access to dental care as evidenced by the ratio of EPSDT enrollees and dentists in the county.

According to the re-licensure survey, there were 13 counties without a practicing dentist. While the Dental Board statistics by county over-estimates the available workforce, the re-licensure survey under-estimates the available workforce because of non-response. A separate survey could be implemented through or in partnership with the Missouri Dental Association to quantify the available dental workforce in Missouri.

While the aging of the dental workforce has been recognized for some time, the urgency indicated by the re-licensure data requires immediate attention. Dentists in only 50 counties in the state indicated no retirements in the next five years, and 30 counties indicated no retirements in 10 years. Considering that many of Missouri's counties are rural, the problems with access to care could get significantly worse within the next five to 10 years.

To alleviate the looming workforce shortages, efforts need to be stepped up by Missouri stakeholders to coordinate efforts to attract and retain new dentists to Missouri, in addition to those UMKC School of Dentistry graduates expected to practice in Missouri. The data collection pertaining to retiring dentists need to be improved; tracking new hires with the help of the Dental Board will help identify potential areas likely to be losing dentists. This not only has implications for the populations in those counties, but also will affect the auxiliary workforce needed to maintain a viable dental practice.

Limitation

The results of this study should be viewed with the limitations inherent with the survey process. The dental re-licensure survey had a lower than expected response rate. This becomes a significant issue in counties where there are few dentists as non-response will magnify inherent survey biases. Another limitation from non-response is the blending of missing responses and those responses that were zero. For example, it is not possible to know for those counties without a dentist, whether there is no dentist at all, or the dentist(s) did not respond to the survey.

Conclusion

Workforce needs in Missouri vary significantly across different counties. Strategies need to be explored to improve the response rate from license renewal surveys. Considering that the survey has a census design, new surveys exclusively to calculate workforce in Missouri could be considered.

****Prepared by Moncy Mathew, UMKC School of Dentistry, August 12, 2009***



APPENDIX 1



**Projected Dental Workforce Needed in Missouri by County
Using the “Need Based” Model**

County	Without EFDA		With EFDA	
	Dentists	Dental Hygienists	Dentists	Dental Hygienists
Adair County	19	26	16	23
Andrew County	13	18	11	16
Atchison County	6	8	5	7
Audrain County	19	28	16	23
Barry County	27	40	24	33
Barton County	9	14	8	11
Bates County	16	24	14	20
Benton County	14	21	12	17
Bollinger County	12	17	10	14
Boone County	112	166	98	137
Buchanan County	67	100	58	82
Butler County	31	46	27	38
Caldwell County	7	10	6	8
Callaway County	32	47	28	39
Camden County	30	45	26	37
Cape Girardeau County	55	82	48	67
Carroll County	7	11	6	9
Carter County	6	8	5	7
Cass County	73	108	63	88
Cedar County	10	15	9	13
Chariton County	6	9	5	7
Christian County	56	83	49	68
Clark County	5	8	5	7
Clay County	159	236	138	194
Clinton County	16	23	14	19
Cole County	54	81	47	66
Cooper County	13	19	11	16
Crawford County	22	33	19	27
Dade County	6	8	5	7
Dallas County	13	19	11	15
Daviess County	8	11	7	9
Dekalb County	9	14	8	11
Dent County	11	17	10	14
Douglas County	13	19	11	16
Dunklin County	24	35	21	29

Franklin County	74	110	64	90
Gasconade County	14	21	13	18
Gentry County	5	7	4	6
Greene County	200	297	174	244
Grundy County	8	11	7	9
Harrison County	7	10	6	8
Henry County	17	25	15	20
Hickory County	9	13	8	11
Holt County	4	6	3	5
Howard County	7	11	6	9
Howell County	37	55	32	45
Iron County	7	11	7	9
Jackson County	495	734	431	603
Jasper County	87	128	75	105
Jefferson County	160	237	139	195
Johnson County	39	58	34	47
Knox County	3	4	3	4
Laclede County	26	38	22	31
Lafayette County	25	36	21	30
Lawrence County	36	53	31	44
Lewis County	7	11	6	9
Lincoln County	38	57	33	47
Linn County	9	14	8	11
Livingston County	11	16	9	13
Macon County	12	17	10	14
Madison County	9	14	8	11
Maries County	9	13	7	10
Marion County	21	31	18	25
McDonald County	17	25	15	20
Mercer County	3	4	2	3
Miller County	18	27	16	22
Mississippi County	10	15	9	12
Moniteau County	11	16	10	13
Monroe County	7	10	6	8
Montgomery County	9	13	8	11
Morgan County	15	23	13	19
New Madrid County	13	20	12	16
Newton County	53	79	46	65
Nodaway County	17	25	15	20
Oregon County	10	15	9	12
Osage County	13	19	11	15

Ozark County	9	13	8	11
Pemiscot County	14	20	12	17
Perry County	14	21	12	17
Pettis County	30	44	26	36
Phelps County	31	46	27	38
Pike County	14	20	12	17
Platte County	64	95	56	78
Polk County	23	34	20	28
Pulaski County	32	48	28	39
Putnam County	4	5	3	4
Ralls County	7	11	6	9
Randolph County	19	28	17	23
Ray County	22	33	19	27
Reynolds County	5	7	4	6
Ripley County	13	19	11	16
Saline County	17	25	15	20
Schuyler County	4	6	3	5
Scotland County	4	5	3	4
Scott County	30	45	26	37
Shannon County	8	12	7	10
Shelby County	5	7	4	6
St. Charles County	255	378	222	311
St. Clair County	9	13	8	11
St. Francois County	48	71	41	58
St. Louis City	260	385	226	317
St. Louis County	736	1090	640	896
Ste. Genevieve County	17	25	15	21
Stoddard County	22	33	19	27
Stone County	24	36	21	29
Sullivan County	5	7	4	6
Taney County	35	52	31	43
Texas County	19	28	16	23
Vernon County	15	22	13	18
Warren County	23	34	20	28
Washington County	23	34	20	28
Wayne County	10	14	8	12
Webster County	34	51	30	42
Worth County	2	3	2	2
Wright County	18	26	15	21

